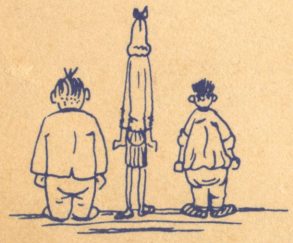
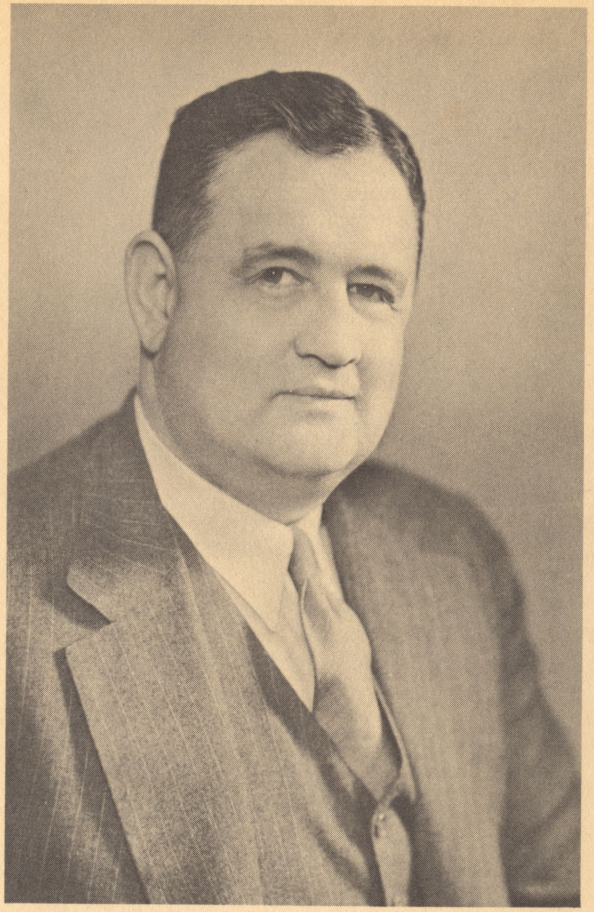
CHARLES STARK DRAPER





Bachrach

FRONTISPIECE

EFFECTS OF THE INSTRUMENTATION DIRECTOR UPON DEFENSE MECHANISMS, INSTRUMENTS OF DEFEAT, APPARATUS OF FLIGHT, AND PERSONNEL WITH WHOM ASSOCIATED

Summary -- Characteristics investigated include a penetrating scholarliness, infectious good fellowship, high professorial coefficient, and low opinion of gadgetry that doesn't do what it's supposed to. Impact of LaStark transform on reluctance of The Brass is correlated with disturbance produced in Draper figure. Combat success demonstrated that this effect had possible practical applications. The ratio, r, of the amplitude of the energy of administration at infinity to the brilliance of ingenuity is determined. If there was any question prior to this study that the constant pi, to four places, varies from a value of 3.1416, the editors are prepared to forward rigid graphical proof to the contrary (ref. Draper Doodles).

FIG.I DISTURBED DRAPER FIGURE

Charles Stark Draper, Professor of Aeronautical Engineering and Director of the Instrumentation Laboratory at Massachusetts Institute of Technology, departed from the accepted order of things, some twenty-five years ago, when he prepared himself for the interpretation of physical phenomena by qualifying for the baccalaureate degree in psychology. This unorthodox introduction to inventive mechanics permits of interesting hypothesis as to why the Doctor has produced devices of more than human precision, of almost human perception, and of less than human distaste for perspiring solution of complex problems.

One of the Doctor's most noteworthy instrumentations (a word more descriptive of the Draper technique than the usual 'invention') was well under way by the time the Prince of Wales and the Repulse were lost off Malay under devastating aerial attack. Late in 1940, in a casual conversation with some intimate friends, the Doctor had speculated on the impotence of the admittedly excellent French artillery in trying to halt the sweep of the German tanks across France. He asserted that the French had lacked a device to give their guns an anticipatory

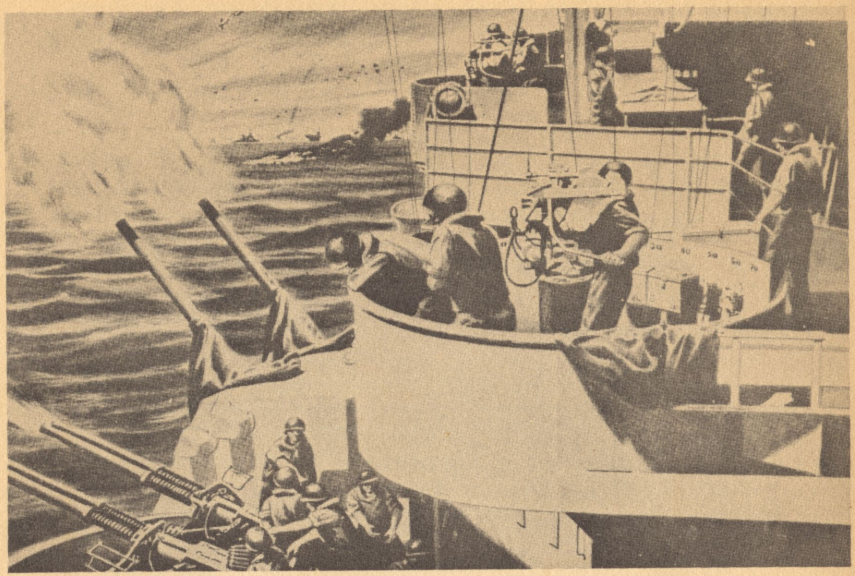


FIG. 2 SKETCH SHOWING GUNSIGHT MARK 14 IN ACTION

psychosis for the moving German armor, and then led with his chin by stating he had a gadget that could do it. The whole thing picked up momentum, with the Doctor launching a full development program in joint sponsorship with an instrument manufacturer. But the stage of things abroad had progressed as well, and the troublesome targets were now in the air. The British Navy threw its weight in the breach with the disturbed plea to "rather make it go crosswise, old boy! This Luftwaffe is a bit of a bother, you know." While the Doctor was preparing to oblige, the U.S. Navy began to echo the roar of the Lion. All that was needed, in the words of one gunnery officer, was "a little gismo to do four hours of conic sections and differential calculus in a split second."

It did. On October 26, 1942, Mark 14 gunsights stood combat baptism when Battleship X, the USS South Dakota, shot down thirty-two Jap planes in her first major engagement.

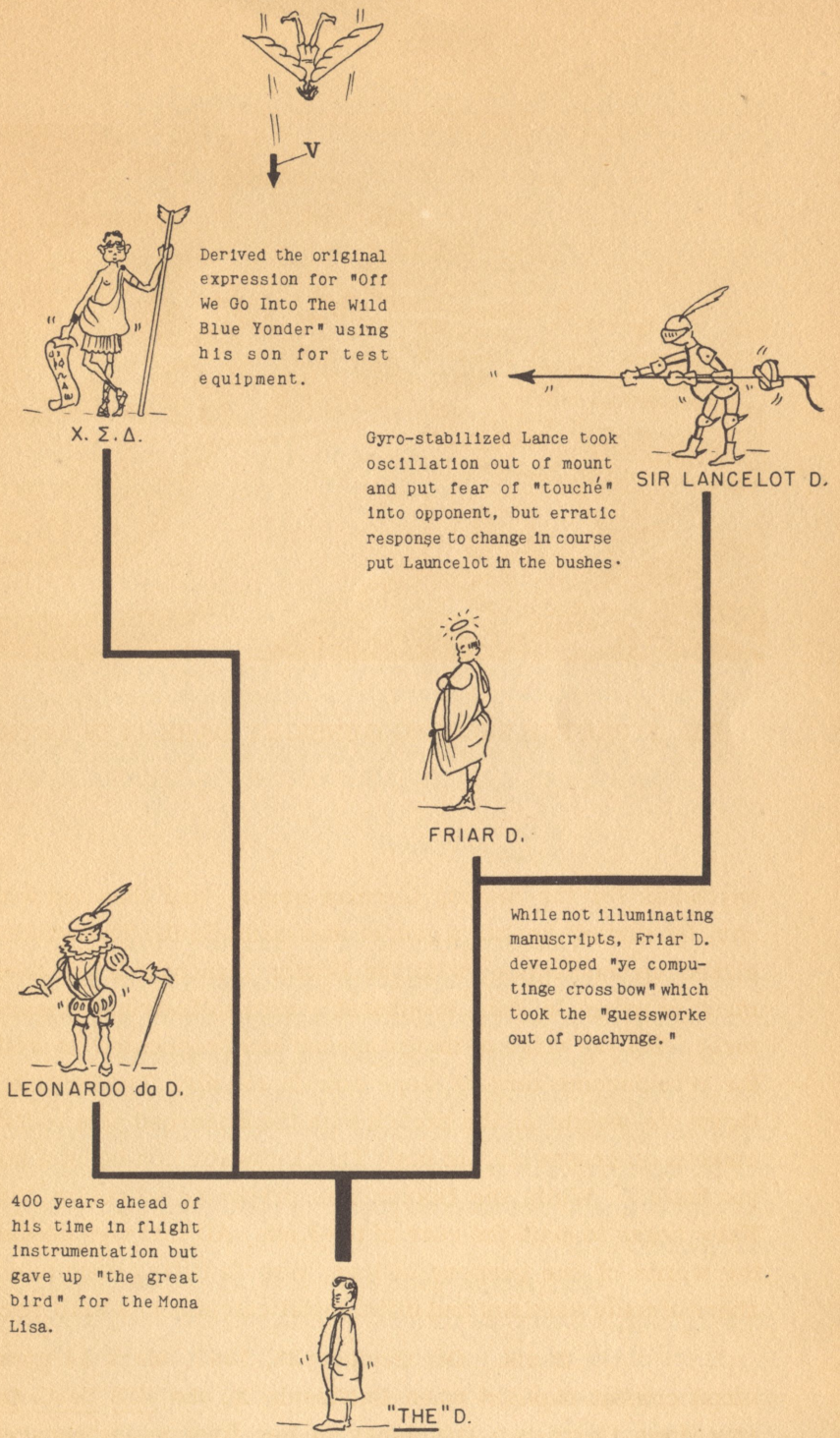
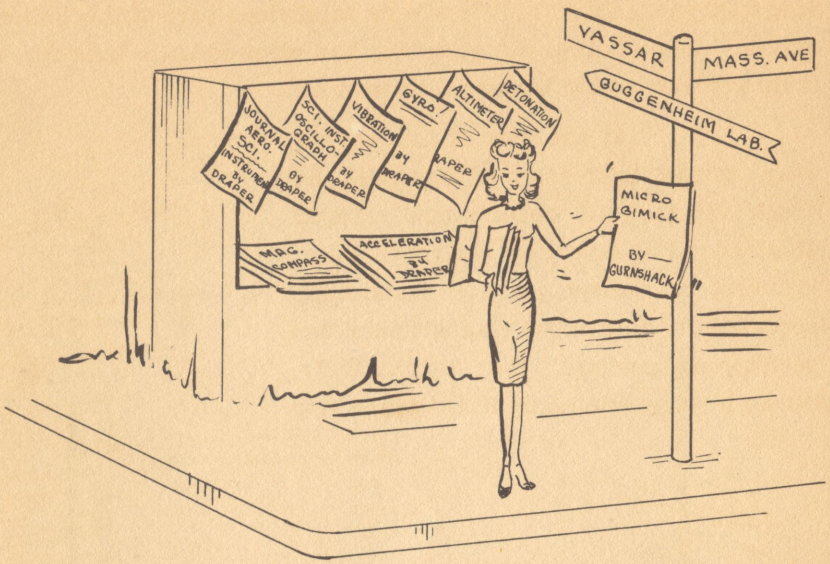

V
Derived the original expression for "Off We Go Into The Wild Blue Yonder" using his son for test equipment.
X. Σ. Δ.
Gyro-stabilized Lance took oscillation out of mount and put fear of "touché" into opponent, but erratic response to change in course put Launcelot in the bushes.
SIR LANCELOT D.
FRIAR D.
While not illuminating manuscripts, Friar D. developed "ye compu-tinge cross bow" which took the "guessworke out of poachynge."
LEONARDO da D.
400 years ahead of his time in flight instrumentation but gave up "the great bird" for the Mona Lisa.
"THE" D.

FIG. 3 RELATIONSHIP OF X.Σ.Δ. SIR L.D., FRIAR D., AND L. da D., to DR. D. IN THE INSTRUMENTATION PROBLEM



Note: This is a direct libel on the Doctor. Miss Priscilla Mead does not sell the pamphlets. She is simply filling in for the regular man who is out to lunch.

FIG. 4 FIELD STATION FOR ADVANCED DISTRIBUTION OF DRAPERIAN LITERATURE ON INSTRUMENTATION

It is the purpose of the balance of this report to document the Draperian legend as it accelerates from its origins in antiquity, passes through the Newtonian period and emerges in full flight, A.D. 1947. Liberal use has been made of tables, charts, and figures to illustrate what may conveniently be called the text. Unfortunately, much of the Doctor's classic notation and terminology has perforce been omitted -- no format in its right mind would shoulder the requisite additional charts, tables, and figures.

Dr. Draper was born at Windsor, Missouri, October 2, 1901. Today he retains a property, Cagwin Farm, near the heart of the Ozark country, which still beckons with the call of the razorbacks. Of course the place sometimes costs a little more to keep up than is offset by occasional harvests, but by and large, says the Doctor, it is a very salubrious part of the United States. Regrettably, his program has allowed little time for a farm retreat, or for his home state at all.

At the end of his second year at the University of Missouri, he shook off the hill country and entered Stanford. Two divergent activities color his western student years -- functioning successfully as campus photographer, and performing perhaps less spectacularly, but no less determinedly in the prize ring.

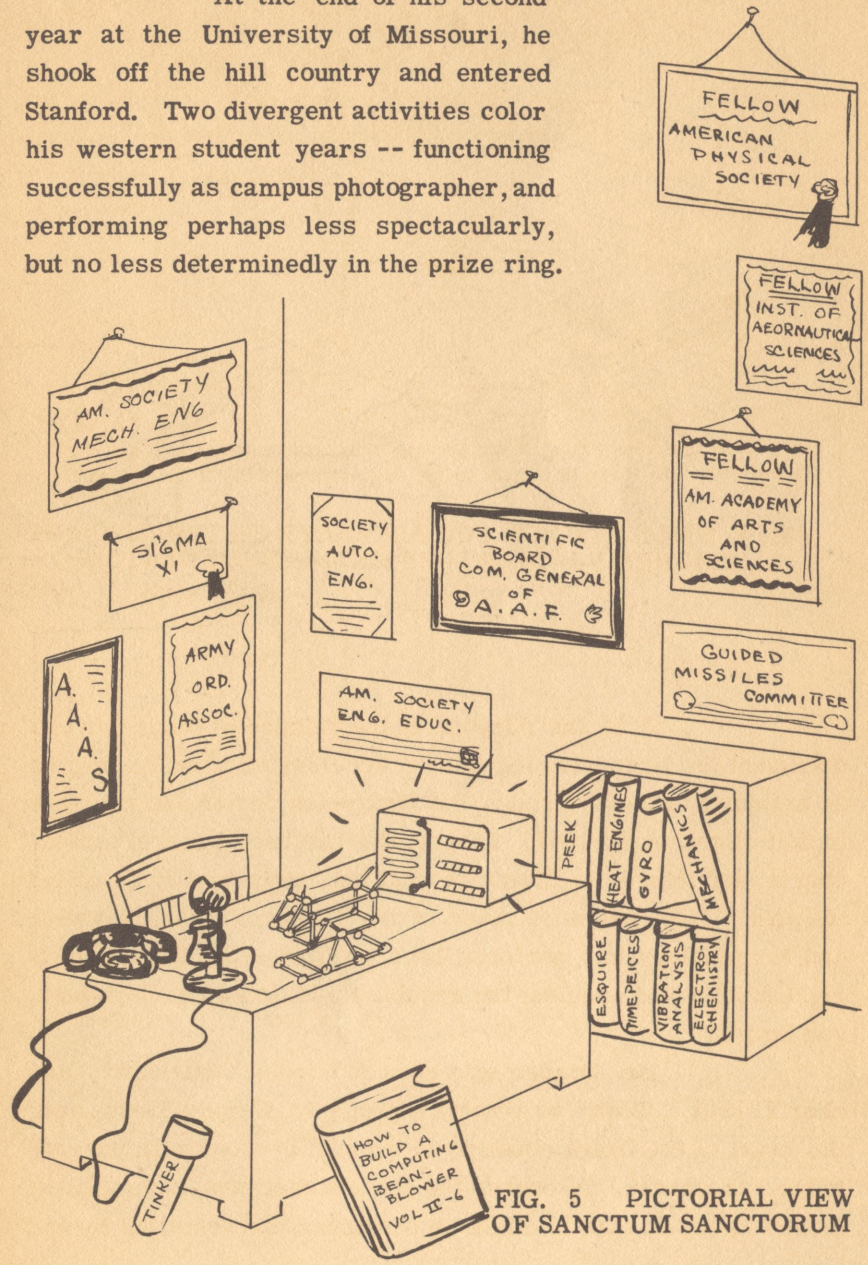


FIG. 5 PICTORIAL VIEW OF SANCTUM SANCTORUM

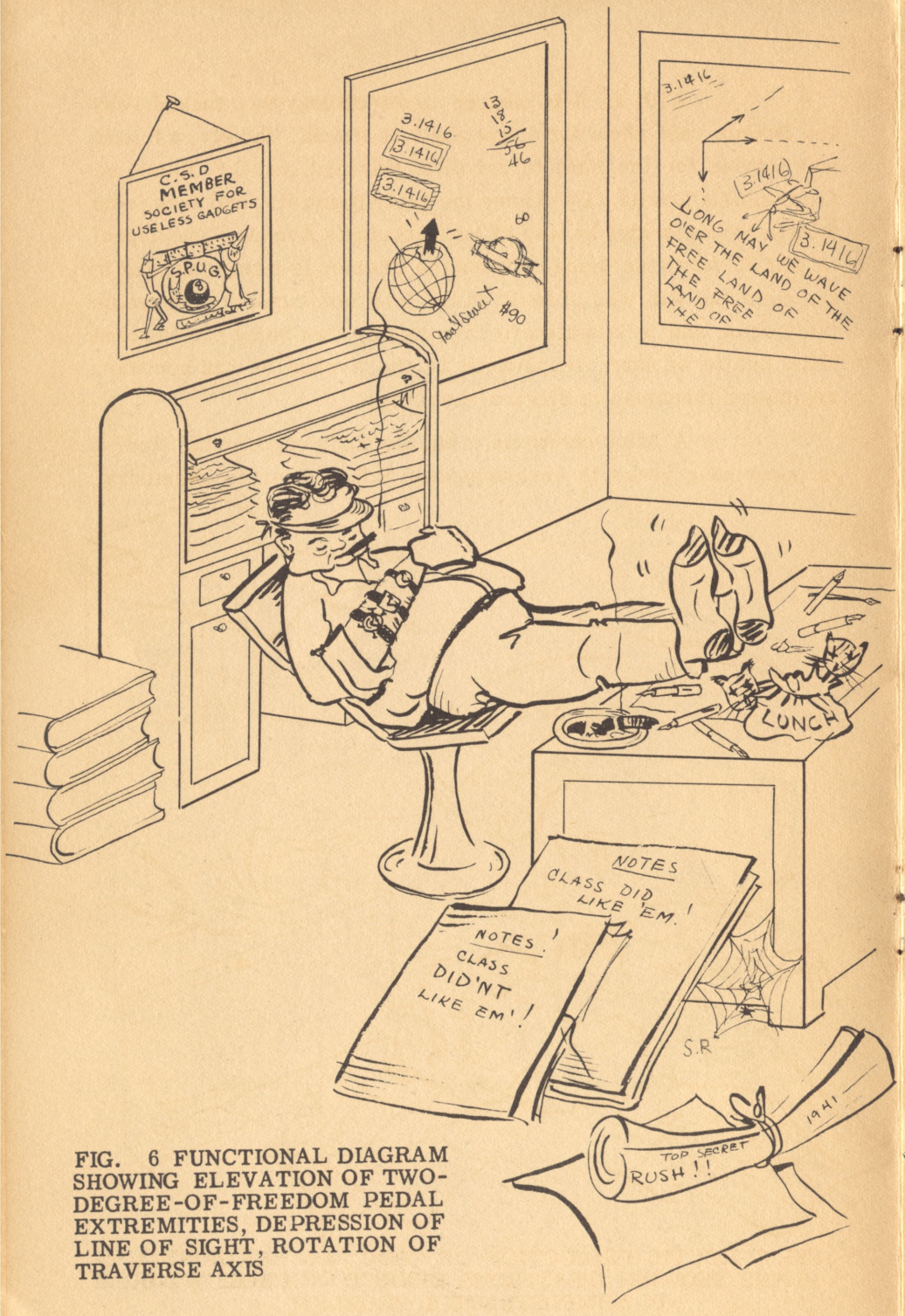


FIG. 6 FUNCTIONAL DIAGRAM SHOWING ELEVATION OF TWO-DEGREE-OF-FREEDOM PEDAL EXTREMITIES, DEPRESSION OF LINE OF SIGHT, ROTATION OF TRAVERSE AXIS

With an A.B. degree in Psychology then tucked away the Doctor cast about for a new angle of attack. Happily, a friend was leaving for the East to enroll at Harvard, and C.S. joined in the trip as a tourist. By chance the party began its final trek from Boston to Cambridge by way of Massachusetts Avenue. The aspect of M.I.T. from the bridge across the Charles is intriguing, and by the time the car was abreast of the Institute, curiosity overcame the Doctor and he alighted to investigate. Not being one to stand still, before he later reappeared on the Avenue he had become a registered freshman in Electro-chemistry.

A brief chronicle of the Doctor's engineering studies in succeeding years is here appended: S.B. in Electro-chemistry;

FIG. 7 HECTIC PROJECTION OF "DOC" ON HORIZONTAL PLANE SHOWING DISASTROUS EFFECT OF CROSS WIND ON ADMINISTRATIVE PROBLEM

Bares Gunsight That Stopped Japs

the most closely guarded military secrets of the war—a gyroscopic of Sperry which has made our fleet relatively invulnerable to at- ed today with the permission of the Navy.

ad eclipsed seapower as a naval aircraft guns was a match for sky eapon and this impression was raiders. Before they could strike, engthened in certain quarters Japanese planes were shot the British naval craft 'Re by the South Dakota in her and 'Prince of Wales' wa ajor engagement on Oct. dive bombing and tor Representing the cul- ttacks," Morgan conti American ingenuity ships were not e ill, the South dern anti-aircr with the lat- the day of ' ers fire passed,' s ists.

urth Street, donor of the award. Institute, Inc., 2 East Sixty-fourth ences, Inc., and to other computing devices," and the gyroscope sights for application of was announced yesterday by the ff was awarded for 1945 "for gunnery Aeronautical Sci- won the Sylvanus Albert Institute of Technology, has Aeronautical Engineering in charge of instrumentation at Massachu- Prof. C. S. Draper, Professor

Charles S. Draper, Professor of Aeronautical Engineering in charge of instrumentation at Massachusetts Institute of Technology, has been awarded the Sylvanus Albert Reed Award for 1945 "for application of the gyroscope sights for gunnery and to other computing devices," it was announced yesterday by the Institute of the Aeronautical Sciences, Inc., donor of the award. Sixty-fourth Street, assistant Hugh L. Dryden

WINS AERONAUTICS AWARD

Institute of Technology, who had been collaborating in the study of rate gyroscopes for several years, started work on the problem in 1940. In June of that year Dr. C. Stark Draper, director of the instrument laboratory of MIT, made a complete mathematical analysis of the conditions to be met.

By Sept. 1940 Dr. Draper had developed the principal features of a sight which would meet the conditions. At first it seemed impossible to obtain the characteristics indicated by Dr. Draper's analysis be- the automatic lead angles re- opic mounting frictionless but anism requ- ver

and calibration without preced Flatness, width and thickne the beryllium copper sprin to be held to an accu 1/10,000 of an inch; which 1/20th the size of human ha

The small thermostat had to hold damping fluid temperature constant within one degree over a range of minus 20F to plus 18F.

In time all these problems were solved, the president of Sperry continued. The Navy placed sights in October 1942 tember 1942 creased. Jan

Steel 'Robot' Helped U. S. Navy To Repel Kamikazes' Attacks

ROCHESTER, N. Y., Jan. 17.—(AP) A steel 'robot,' eight feet high nd weighing one ton, gave Navy hips blind-firing power against Japanese kamikaze and other attacks late in World War II, man Kodak Company disclosed day.

The Mark 57 gu ing both radar a devices, permit follow an en day, throu compar

Compton Cites MIT's War Role, 400 Tasks Worth 98 Millions

By W. E. PLAYFAIR

Emphasizing the important role played by the nation's educational institutions during the war, President Karl T. Compton of Massachusetts Institute of Technology yesterday reported that in the last five years the Institute had engaged in 400 projects in research and special training in connection with the war effort with a total value of $98,248,500.

"Whereas the Army and Navy constitute our first line of national defense," Dr. Compton told the corporation of the Institute in his annual report, "I venture the statement that our educational institutions rank with our manufacturing industry and transportation system as the principal supporting lines of military power in time of war and of reserve strength in time of peace.

"In peace, they educate men for every aspect of our national economy in which higher education is important. In war, they are ready-made centers for housing and training officers and specialized personnel. Their faculties are the most readily available source of experts for the numerous emergency boards, committees and expanded technical services.

"Their laboratories and staffs become productive centers for research and development in new instrumentalities of offensive and defensive warfare.

"The most widely used and effective new weapon of this war was radar, which received its principal war development, especially in the microwave version, at the Massa-

(Continued on Page Twelve)

MIT TASKS IN WAR

PLAYFAIR

m First Page)

training was The lengthy list of war contri- stitute's course in butions of the Institute listed by engineering. President Compton included the ne-war staff work of Prof. Robley D. Evans of granted the radioactive laboratories in de- a wide veloping methods for the preserva- tion of whole blood for the troops; man- overseas; superhigh voltage x-ray ing urits for the examination of cast- lings and munitions; research in fuel, insulation, liquid oxygen, chemical warfare; and the oxygen- models of military airplanes. "The war gave great impetus to developments in machine calculations and as a consequence we have opportunities in this field of a magnitude beyond anything we have yet undertaken," Dr. Compton said.

50 P. C. MORE STUDENTS

In its enormous war program, M. I. T. adopted a policy that would accept no profit for the work it undertook for the government. In fact, the Institute made a 'substantial over-all out-of-pocket contribution."

"This contribution," he said, "was made freely and gladly and was entirely proper since the war was costly to the entire nation and to every patriotic element in it."

Turning to problems of transition from war to peace, Dr. Compton said that student applications, including a large number of veterans, indicate that by next spring the Institute's enrolment will have increased 50 per cent above the normal stabilization registration of approximately 3000.

doubling its en- postgraduate U. ers, the Institute, at the of the Navy, also trained naval construction and engineer- a considerable number of naval officers from China, Turkey and Brazil.

Next to radar, the war achievements of which were of incalculable value, the M. I. T. development most extensively used in the war, was the gunsight, developed by Prof. C. Stark Draper, which introduced the angle in firing at whether tanks or was particu- Japanese

THEY PUT LIFE IN AERONAUTICS

Engineering Specialists Are Honored at Dinner.

Calling the aeronautical engineers of the United States "the forgotten men of aviation," Lieut.-Gen. James H. Doolittle paid tribute to their great contribution to the winning of the war and pleaded for "the continuation of our wartime research organizations and our wartime rate of development" at the Honors Night victory dinner of the Institute of the Aeronautical Sciences last night in the grand ballroom of the Waldorf-Astoria.

The Awards.

The Daniel Guggenheim Medal to Theodore P. Wright, CAA administrator, for outstanding contributions to the development of civil and military aircraft, the presentation made by Dr. J. C. Hunsaker, chairman of the National Advisory Committee for Aeronautics; the Sylvanus Albert Reed Award to Prof. Charles S. Draper of M. I. T. for application of the gyroscope to computing sights for gunnery and to other computing devices, by Dr. Hugh

Doolittle Terms Air Research Key to Security

Calls for Federal Su If Need Be; 8 H by Aeronautical

Future security of States depends upo sive continuation o war-time researc Lieutenant Gene little said last tute of Aeron tory dinner nautical en for their con- Addressin grand ball- Astoria, C United finance "charr tensi- fie done built by physics University

his part in the invention of a means of applying the gyroscope to cmputing sights for gunnery and to other computing devices, such as radar.

Professor Draper's sight, classified by the Navy as the "Mark 15," was especially effective against a moving target. It was proved by the Navy anti-air- against the Japa- lanes. The device, size of a por- judgment' ing ir

of the Wright C. S. the Casey nautics. D. Gardner, council; executive R. Forman, dent; Robert and Joseph

Robot Gun Director Navy Blind-Firing Po

Rochester, N. Y., Jan. 17.—(AP)— The computer Mark 17 installed in the director to relay movements to another computer below decks, was described as the "brains" of the director which replaced the massive radar indicators in the ship's superstructure and complex devices on deck which directed anti-aircraft fire earlier in the war.

The system, the company said, was the outgrowth of new fire control development begun at Massachusetts Institute of Technology under Dr. Stark Draper. Johns Hopkins University engineers working under the Office of Scientific Research and Development contributed to the design.

Also producing the device was division of Borg-Warner Corp. Norge development work was done from a wooden-scale model by scientists of the applied physics laboratory of Johns Hopkins University in 1943.

In recognition of its work on the device Norge today was presented with the naval ordnance development award for "outstanding contri-

tions to the resear dent of naval ordna The presentation rice-Admiral George hief of the Bureau o Howard E. Blood. No who also was given a sp cor work on the project. Ian a T. Lamson Ill, test pilots fo Company.

following officers for 1946 inducted at the dinner Arthur E. Raymond ident, Arthur of engineering president of Douglas Aircraft Company; vice presidents, P. R. Bassett, presidents of Sperry Gyroscope Company J. H. Kindelberger, president North American Aviation, John C. Leslie, vice-president trans-Atlantic operations, American Airways, and Bur S. Wright, vice-president in c

"Robot" Directed U. S. Guns on Jap Kamikaze Pilots

ROCHESTER, N. Y. Jan. 17 (AP)—A steel "robot," eight feet high and weighing one ton, gave Navy ships blind-firing power against Japanese kamikaze and other aerial attacks late in World War II, Eastman Kodak Company disclosed today.

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Gunsight ap Planes

ark 51 director o utilize the N control of 4 uad mounts and e guns. This move enab an ships to reach e enemy planes ey could go into Morgan declare

Wizard M. I. T. Gyro Gunsight Ends Air Mastery Over Sea

Dr. Draper Invented, Sperry Firm Made It

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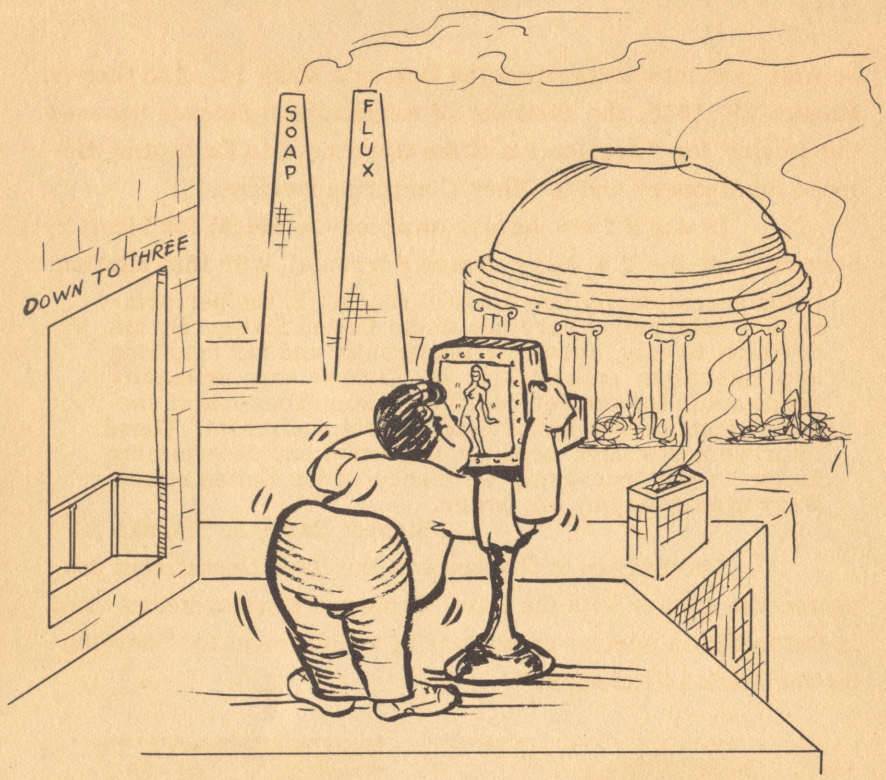


FIG. 8 PROF. DRAPER IN PRELIMINARY STUDIES PRIOR TO CLASS DISCUSSION

established one-man laboratory for development of Naval infrared signaling; S.M. in Aeronautical Engineering; Research Assistant and Associate in this same field, Assistant Professor in 1935.

The Physics Department of the Institute awarded him the Doctorate of Science in 1938, and he assumed an Associate Professorship, with full rank as Professor in 1939.

1941, for reasons already outlined, saw Dr. Draper assume command of the new Confidential Instrument Laboratory. There follows, for security reasons, a hiatus in recognized achievement, but about the time of V-E day it became possible to mention the Doctor's Mark 14. And then on January 29, 1946, the Institute of Aeronautical Science honored the Doctor for "Application of the Gyroscope to Computing Devices for Gunnery and to Other Computing Devices."

In April 1946, he was awarded the Medal for Merit by Secretary of the U.S. Navy, James Forrestal, with this citation:

> ...for exceptionally meritorious conduct in the performance of outstanding services to the United States. By his devotion to duty, scientific leadership, and his inspiring and infectious enthusiasm, Dr. Draper was primarily responsible for the development of numerous major improvements in antiaircraft fire control equipment. These improvements have been an important and determining factor in the increasing efficiency of the United States Navy against enemy air power.
>
> Signed: Harry S. Truman

The Bureau of Ordnance of the Navy Department presented the Doctor with the Naval Ordnance Development Award in October, as a special certificate of achievement for "developing the Mark 14 Gunsight."

Official U.S. Navy Photo

FIG. 9 THE FORRESTAL AWARD

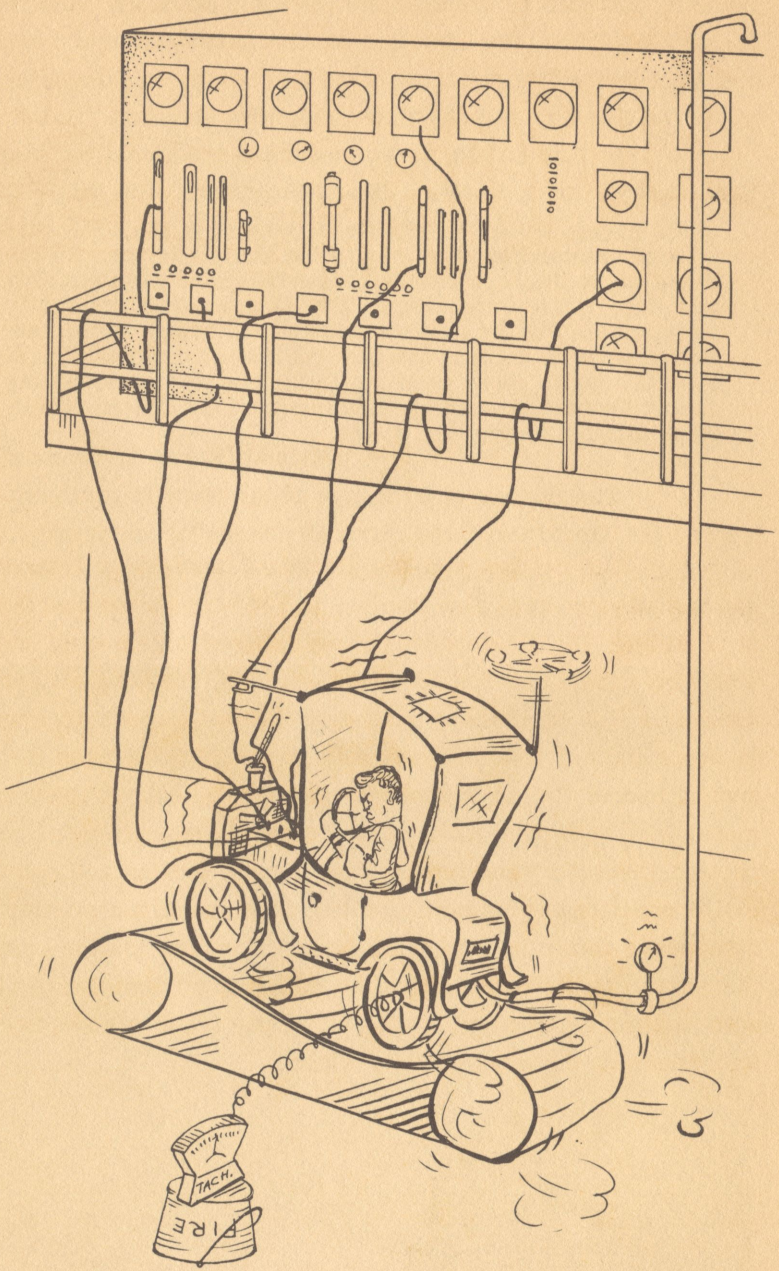
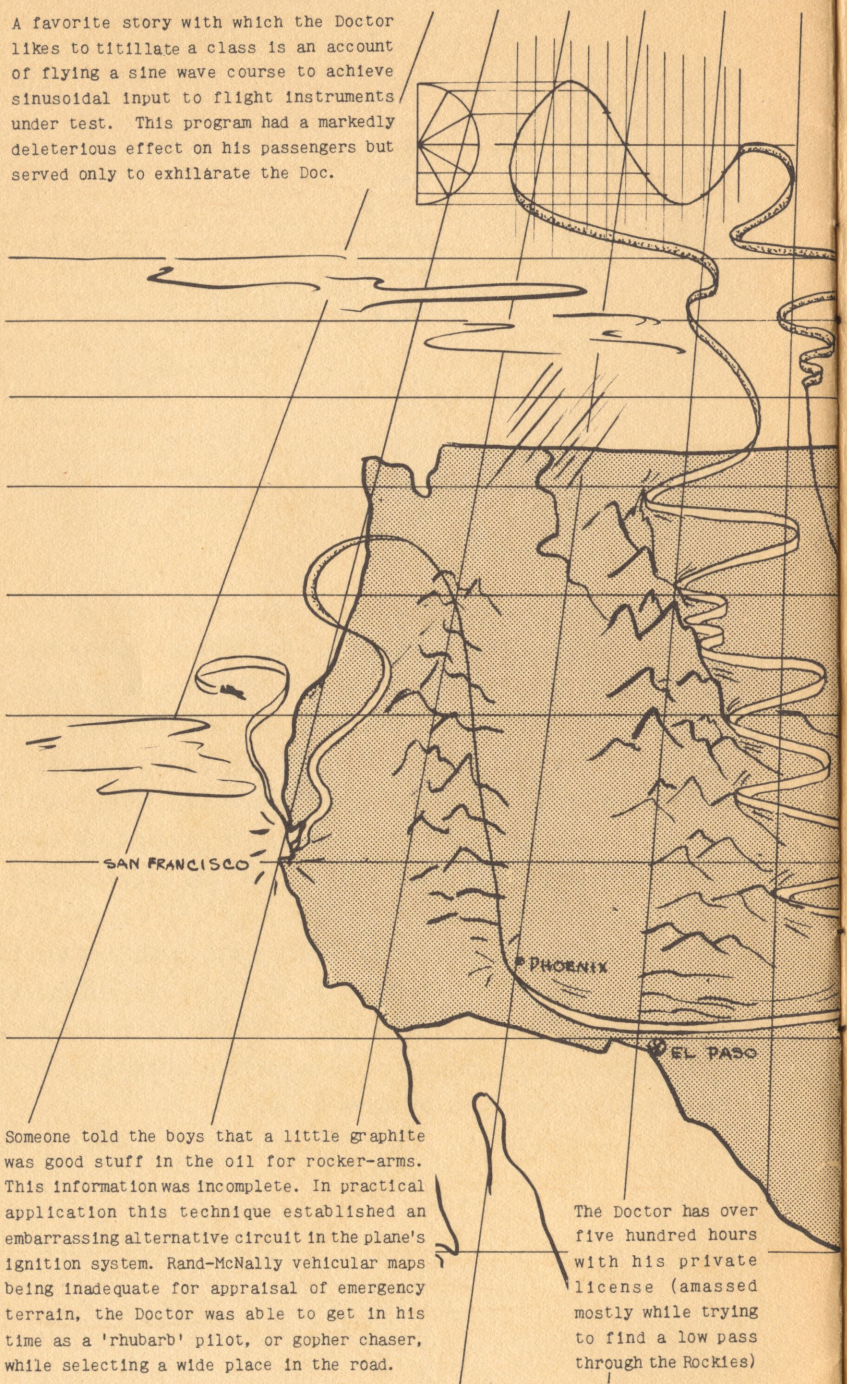


FIG. 10 TEST SETUP FOR THE DOCTORAL DISSERTATION "PHYSICAL PROCESSES ACCOMPANYING DETONATION IN THE INTERNAL COMBUSTION ENGINE"

FIG. 11 CAGWIN FARM

But renown and the attendant harvest of floor space had not always been the Doc's. In 1934, up on the fourth floor of Building 33, Professor Draper shared his modest cubicle with two candidates for advanced degrees, elbowing all sorts of apparatus out of the way whenever he had papers to correct. In those days a few hundred dollars would have been the total annual budget for an advanced research project. A little arithmetic will show that when basic research, experimental construction, laboratory and field testing, report writing and commercial production are staggering along concurrently, a similar sum disappears today in barely an hour. Only one matter remains the same. In the Doc's office the midnight oil continues to burn with undiminished glow, as he earnestly tries to make twenty-four hours do the work of forty-eight.

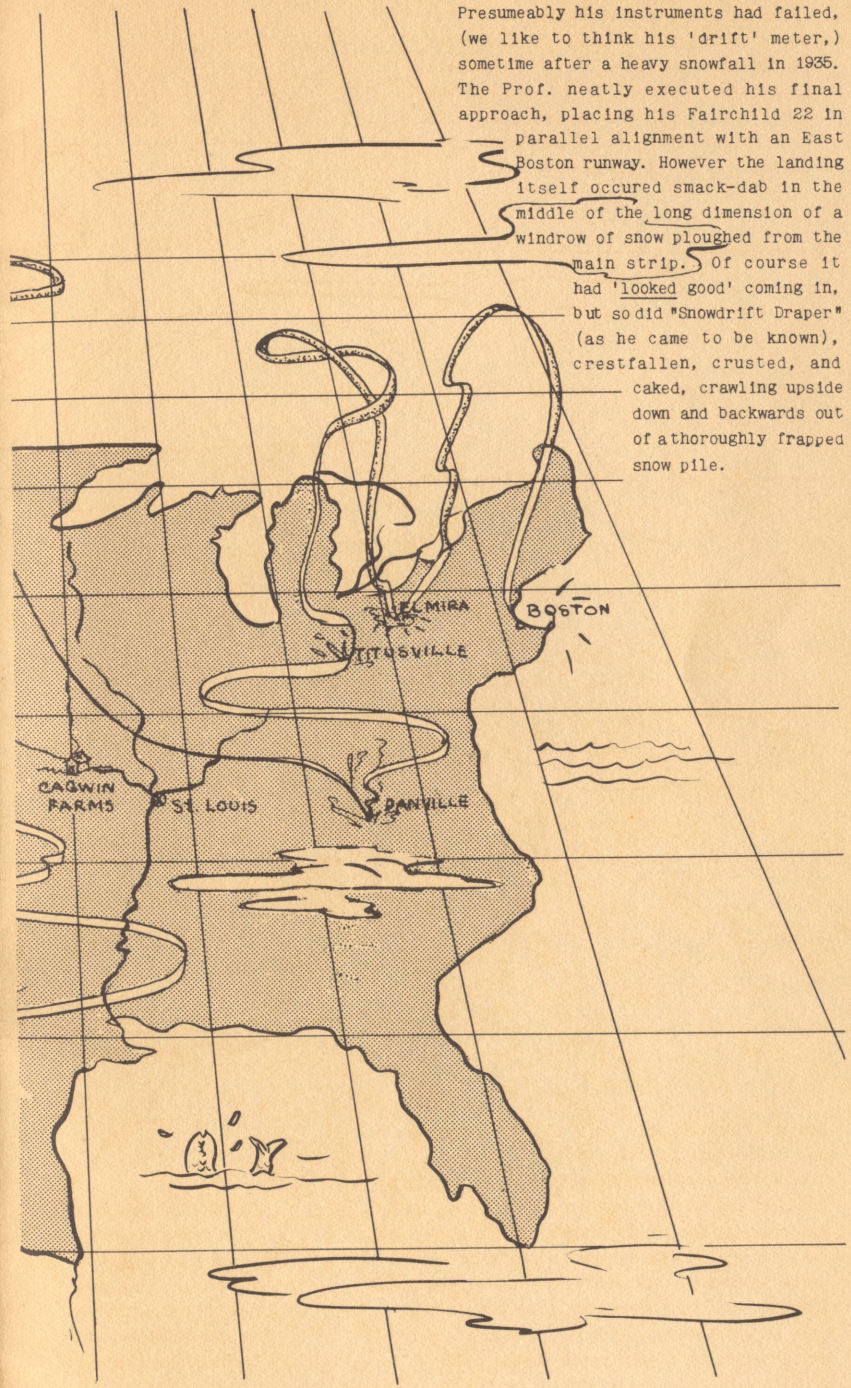


A favorite story with which the Doctor likes to titillate a class is an account of flying a sine wave course to achieve sinusoidal input to flight instruments under test. This program had a markedly deleterious effect on his passengers but served only to exhilarate the Doc.

Someone told the boys that a little graphite was good stuff in the oil for rocker-arms. This information was incomplete. In practical application this technique established an embarrassing alternative circuit in the plane's ignition system. Rand-McNally vehicular maps being inadequate for appraisal of emergency terrain, the Doctor was able to get in his time as a 'rhubarb' pilot, or gopher chaser, while selecting a wide place in the road.

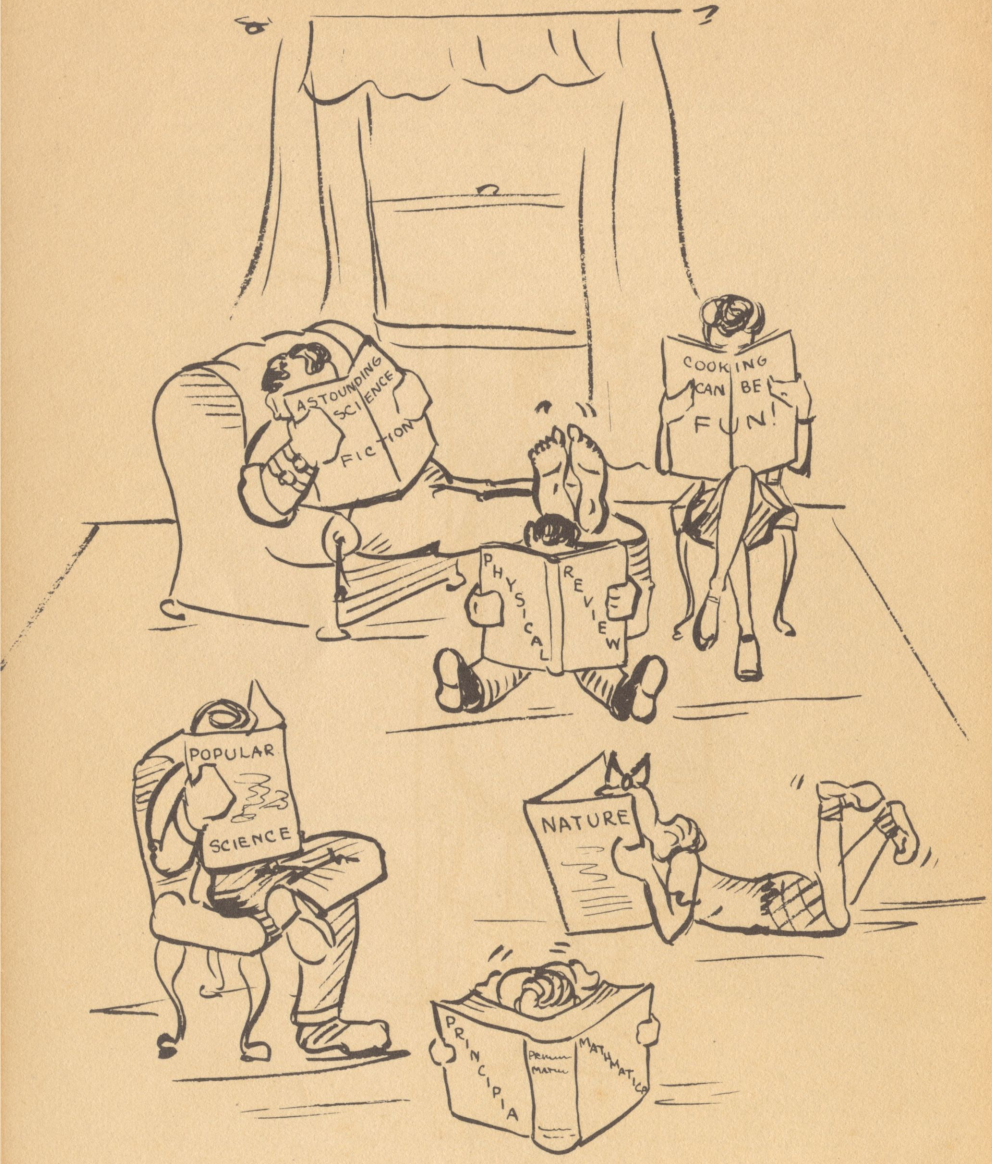
The Doctor has over five hundred hours with his private license (amassed mostly while trying to find a low pass through the Rockies)

FIG. 12 SCHEMATIC DIAGRAM SHOWING RELATIONSHIP OF GEOGRAPHICAL AND



Presumeably his instruments had failed, (we like to think his 'drift' meter,) sometime after a heavy snowfall in 1935. The Prof. neatly executed his final approach, placing his Fairchild 22 in parallel alignment with an East Boston runway. However the landing itself occured smack-dab in the middle of the long dimension of a windrow of snow ploughed from the main strip. Of course it had 'looked good' coming in, but so did "Snowdrift Draper" (as he came to be known), crestfallen, crusted, and caked, crawling upside down and backwards out of a thoroughly frapped snow pile.

EXTRATERRESTRIAL PEREGRINATIONS OF C. S. DRAPER et al., circa. 1931



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